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INHALER

TECHNICAL FIELD

The present invention relates to a device for use with an inhaler, the inhaler comprising a body, an aerosol canister arranged in said body containing medicament, comprising a metered dose chamber and able to dispense a metered dose of said medicament, a nozzle in fluid communication with said canister, an opening for dispensing of said medicament in fluid communication with said nozzle, where said device comprises means for activating said canister to open and dispense said medicament in response to inhalation of a user through said opening and return means for deactivating said canister to close it and refill/recharge the metered dose chamber.

BACKGROUND OF THE INVENTION

For a number of years inhalers have been used to deliver a metered dose of medicament to the respiratory tract of a patient. Basically there are three types of inhalers, adapted for powder medicament, aerosol driven fluid medicament and nebulisers.

The primary design of most of the inhalers are basically the same for the different forms of medicament; a housing containing a supply of the medicament, a mouthpiece, air flow conduits in connection with the supply of medicament and activating means for generating delivery of a metered dose of medicament. The activating means have a wide variety of constructions and functions. These include activation by the patient's hand, such as squeezing the inhaler or manoeuvring a button, during inhalation, electrically activated dose delivery, and inhalation activated dose delivery, for example.

Apart from delivery of a metered dose, most inhalers are also arranged with refilling/recharging means, that is, the chamber or

compartment containing the metered dose has to be refilled/recharged after delivery, or before the next dose is to be delivered.

The drawback of the patient activated inhalers is that it may be difficult for some persons to activate the inhaler and inhale at the same instant. If these actions are not quite synchronised, the patient receives an inadequate amount of medicament into the respiratory tract. Many of the recent designs of inhalers are therefore breath activated wherein the device is activated by inhalation. This causes the canister to be depressed and deliver its metered dose.

One problem with these inhalers is that the canister remains depressed until the patient physically intervenes and removes the pressure on the canister. The chamber may not be refilled completely with these types of inhalers, especially when the amount remaining in the canister is low, because the user may hold the canister of the inhaler in a non-vertical position during the action activating/refilling of the inhalers metered dose chamber. If the level of medicament is low, it cannot then flow into the metered dose chamber in this position. Instead the chamber is filled with the propellant gas. During the subsequent dose, the patient will receive a reduced dose of medicament, perhaps only propellant gas.

Another problem with some breath-activated inhalers is that the inhaler allows for the canister to be compressed for substantial periods of time, resulting in reduced functionality of the valve mechanism.

Document US-A-5,826,571 discloses a breath-activated inhaler comprising an activating means which depresses the canister in response to inhalation and return means for automatically

deactivating or non-depressing the canister in response to the activating means. The inhaler further comprises control means for controlling the time the canister is open, i e the time between activation and deactivation. The return means also provides a refill of the metered dose chamber of the canister during deactivation.

One problem associated with the above inhaler is that the device controls the opening time of the canister, i e the time the canister is depressed, in order to insure that the whole dose is delivered. With the canisters presently on the market, the pressure is such that the major part of the metered dose is delivered during the first 200-300 ms after the canister opens. A remaining part is delivered during the subsequent period of time. For the previous breath-activated inhalers, the opening time posed no problem, since the canister remained open after activation until it was physically recharged. With the inhaler according to US-A-5,826,571 the opening time controls the return means to deactivate the canister. A further aspect in this respect is the repeatability of the inhaler, which is one of the requirements of such a product from national authorities approving medicaments and products associated with these.

The opening time of US-A-5,826,571 is controlled by a viscoelastic element. This element may be adjusted so that the required opening time is obtained when the inhaler is assembled at the factory, and even during some period of use. But repeated use, and time itself, will likely change the properties of the viscoelastic element so that the opening time varies. If shorter, the whole metered dose will not be delivered to the patient, with a deteriorated inhalation quality as a consequence due to doses delivered that are inadequate to the patient.

On the other hand, if the opening time is too long, the patient may remove the inhaler from the mouth and position it in a non-vertical position before the canister is closed and the metered dose chamber is closed. If the level of medicament then is low an inadequate refill of the chamber is obtained, as described above, and the patient does not receive its correct medicament during the subsequent inhalation.

A general problem with the known inhalers is that there is no possibility of monitoring or controlling the inhalation quality of the patient, and from that obtain an indication on the medication, since only the start of the inhalation activates the device.

BRIEF DESCRIPTION OF THE INVENTION

The purpose of the invention is to provide a breath-operated inhaler, rather than breath-activated, without the above problems. This is solved according to one aspect of the invention with a device for use with an inhaler, where the inhaler comprises a body, an aerosol canister containing medicament arranged in said body, comprising a metered dose chamber and able to dispense a metered dose of said medicament, a nozzle in fluid communication with said canister, an opening for dispensing of said medicament in fluid communication with said nozzle, where said device comprises means for activating said canister to open and dispense said medicament in response to an airflow in the inhaler caused by inhalation of a user through said opening, return means for deactivating said canister to close it. The invention is characterized in that said return means deactivates said canister when the air flow drops below a certain threshold value.

According to another aspect of the invention it is characterised in that that the activating means and return means of the device are operated when the canister is positioned with its outlet facing

downwards in the inhaler and that the metered dose chamber is refilled/recharged during deactivation of the canister.

According to yet another aspect of the invention it is characterized in that said activating means comprises a pressure means in contact with the canister, that the pressure spring means are arranged between the pressure means and the housing of the inhaler, spacer means for holding said pressure means, thereby preventing said pressure spring means and pressure means to depress the canister, that the spacer means have certain height and width, height >> width, and are pivotable around an axis parallel to a surface of the inhaler between a position where they are arranged upright with an inclination and a position where they lie flat on the surface, support means for supporting said spacer means in holding said pressure means, the support means comprises a shuttle means, hereafter named upper shuttle means, movable in a vertical direction provided with an upwards facing cam-shaped surface, and first holder means for releasably holding the upper shuttle means in an uppermost position, whereby the spacer means are in contact with said cam-shaped surface in such a way that they are in their upright position, and release/return mechanism which is activated in response to an airflow due to inhalation, whereby, upon inhalation, said release/return means affects the first holder means to release the upper shuttle means whereby it is moved downwards due to the pressure spring acting on the pressure means acting on the spacer means.

According to another aspect of the invention, it is characterised in that the spacer means comprises levers, extending substantially in the same direction as the height of the spacer means, that the ends of the levers are in contact with the cam-shaped surface of the upper

shuttle, where the length of the levers is greater than the height of the spacer means.

The primary advantage of the present invention as compared to known inhalers is that the beginning and termination, i e activation and deactivation, is controlled by the patient's inhalation and not the device, since the start of the inhalation activates the inhaler to deliver its dose and the end of the inhalation deactivates the inhaler, i e closes and refills/recharges it. This in fact increases the inhalation quality in that the end of the inhalation returns the canister to its decompressed position, during which return the metered dose chamber is refilled. This ensures refilling/recharging of the chamber when the canister is held in a vertical position with the metered dose chamber facing downwards. It's virtually impossible to have an improper refilling/recharging of the chamber when the canister has a low level of medicament, thus ensuring that a correct fill and not propellant gas enters the chamber.

Further, with the invention it is possible in a convenient way to monitor if the patient has received the medicament in an appropriate way, by including not only dosage counters but also means for measuring the inhalation time, i e the time the canister has been open during delivery of a dose. This is easily obtained because activation and deactivation are triggered by the inhalation. Thus a measurement of the inhalation time can then be used to evaluate if the patient has received a dose and has been able to inhale the dose properly into the respiratory tract.

As regards the design of the invention, with the use of spring activated shuttles and releasable holder means, a sturdy and compact device is obtained. Also, with the use of a cam-shaped surface acting on the arms of the spacer means, a design with a low

level of force is obtained in order to activate and deactivate the device. This ensures that patients with low physical capacities are able to activate the device, and also, due to the leverage of the spacer means arms, a much lower spring force is required to return the canister to its undepressed condition. This is also an advantage in connection with the new gas propellants that due to environmental aspects are to be changed from CFC to HFA. The HFA propellants require a much higher force in order to activate the canister to deliver its dose. The device according to the invention is able of managing these higher forces without a deteriorated or reduced functionality and handling of the inhaler by the user as compared to known inhalers.

These and other aspects of, and advantages with the present invention will be apparent from the following detailed description of an embodiment with reference to the accompanying drawings

BRIEF DESCRIPTION OF THE DRAWINGS

In the following description of an embodiment of the invention, reference will be made to the drawings, of which:

Fig. 1 shows a side elevation of an inhaler comprising the device according to the invention, with half of the housing removed for clarity,

Fig. 2 is an inhaler of Fig. 1 turned 90°,

Fig. 3 is an enlarged detail view of Fig. 2,

Fig. 4 is a perspective view of Fig. 3,

Fig. 5 is a detailed view taken along line V-V of Fig. 6, and

Fig. 6-9 is the same view as Fig. 3, showing the function of the device according to the invention.

DETAILED DESCRIPTION OF THE INVENTION

In connection to the detailed description, use is made of "vertical" and "horizontal" to define directions of different components. It is to be understood that these directions refer to a position of the inhaler when it is used, to define the relationships between components of the embodiment described, and should not be regarded as limiting the invention.

The inhaling device 10 shown in the figures comprises a housing, in the embodiment shown in two detachable parts, an upper and a lower part 12, 14. The upper part is arranged with a holder/chamber 18 for a metered dose aerosol container 20, hereafter named canister.

The canister, known per se, contains the medicament. It is further provided with a valve assembly 22 in the canister, Fig. 4, comprising a valve stem 24, which normally is urged downwardly by a compressed spring 26. The valve assembly further includes a small compartment or chamber in the canister 27, which chamber defines the metered dose to be inhaled. The valve stem is provided with in- and outlets for filling the metered dose chamber with medicament and delivering the metered dose depending on the position of the stem in the valve assembly, as will be described in detail below.

The lower end of the valve stem is attached to, and supported by, a nozzle 28, which in turn is in communication with a mouthpiece. An air flow passage, not shown, is arranged from an opening 30 on the top of the housing to the mouthpiece 32, shown with broken lines in Fig. 2, arranged on the housing near the nozzle.

The upper wall 34 of the canister holder 18 is arranged with a through hole 36 arranged coaxially with the longitudinal axis of the canister. A piston 38 extends through the hole 36 and is attached at the upper end to a plate 40, hereafter named pressure plate. The lower end of the piston abuts the bottom of the canister. Springs 42 are arranged between the pressure plate and the housing, in the embodiment shown four springs, one in each corner of the pressure plate, where only one is shown in Fig. 3 for sake of clarity, for urging the pressure plate and piston, and thus the canister, downwards.

The inhaler further comprises an actuator mechanism assembly 44. It comprises two spacer means 46 arranged between the pressure plate 40 and the upper wall 34 of the canister holder on opposite sides of the piston. Each spacer means is pivotable around an axis 48 adjacent to, and substantially parallel with, the upper wall 34. In the embodiment shown, the spacer means 46 are manufactured from metal wire bent to specific shapes. The shape as seen in Fig. 3 is a somewhat U-shape where the lower ends of the shanks 50 are provided with portions 52 extending in the direction of the pivot axis. An arm 54 is with one end attached to one of the portions and arranged substantially parallel with the shanks. The other end of the arm 54 is arranged with a guide means, a second portion 56, extending in the longitudinal direction of the spacer and parallel to the pivot axis.

An upper elongated shuttle 58, hereafter named upper shuttle, is slidably arranged in the housing in a substantially vertical direction as seen in the Figures. A support means 60 is arranged at the upper end of the upper shuttle. The support means is in the embodiment shown in the form of a vertically arranged plate with a cam-shaped upper surface 62, in the embodiment shown a somewhat arc-shape. The size and arrangement of the cam and the guide means of the

spacer means is such that the second portions 56 rest against the cam surface 62 when the upper shuttle is in its uppermost position. As can be seen from Fig. 5, when the upper shuttle 58 is in its uppermost position, the spacer means have an inclination α in relation to a vertical plane. The shanks 50 have a certain height h_s and the arms 54 have a length $l_1 > h_s$, where the purpose of the design will be described below. A vertically extending yoke 64, hereafter named inner yoke, is pivotably attached to the lower part 66 of the upper shuttle, extending somewhat above the support means 60. A vertically extending slit 67 is arranged in the upper shuttle. The lower part 66 of the upper shuttle is arranged with a horizontally extending ledge 68.

A horizontally extending first protrusion 70 is fixedly attached to the housing and arranged above the upper shuttle 58 in the vertical direction. When the upper shuttle is in its uppermost position, the yoke 64 is in contact with the upper surface of the protrusion 70. Biasing means (not shown), for example a leaf spring, is arranged to bias the inner yoke 64 towards the protrusion 70, to the left in Fig. 3. A breath-activated release mechanism 72 is arranged adjacent said protrusion 70. It comprises a flap 74 pivotably arranged to a horizontal axis 76. The flap is arranged in an air duct 75 below the air intake 30, Fig. 2. The shape of the flap 74 corresponds to the shape of the air duct, so that a minimum amount of air can pass through when the flap is pivoted upwards against the air duct. The axis is attached to a second protrusion 78 extending horizontally and arranged above the first protrusion 70. The flap is provided with pivoting means (not shown) for urging the flap to pivot upwards, or in a clockwise direction in Fig. 3, and release means 80 adjacent said axis, where the release means comprises a lower and an upper pusher edge, 82 and 84, arranged on each side of the axis 76 and

adjacent the first and second protrusion respectively, the function of which will be described below.

A lower shuttle 86 is arranged outside, to the right of in Fig. 3, the upper shuttle 58, also slidable in a substantially vertical direction. The lower shuttle 86 is arranged with an outer yoke 88 extending substantially vertical with some distance above the second protrusion 78 when the lower shuttle is in its uppermost position. This yoke 88 is also provided with biasing means for biasing the outer yoke towards the second protrusion. The lower shuttle 86 is further provided with a protrusion 90. When the lower shuttle 86 is in its lowermost position, its lower surface abuts the ledge 68 of the upper shuttle. A spring holder/guide 92 is attached to the lower shuttle and extends horizontally into the slit 67 of the upper shuttle. A compression spring 94 is arranged in the slit 67 between the spring holder 92 of the lower shuttle and the upper surface of the slit 67 of the upper shuttle for urging the lower shuttle in a downward direction in relation to the upper shuttle.

Outside the shuttles, a return link 96 is arranged slidable in a substantially vertical direction. A pawl 98 is pivotably arranged on a horizontal axis 100 attached to the return link and connected to spring means (not shown) for urging the upper edge of the pawl against the adjacently located inner wall of the housing. Compression springs 104 are further arranged between the return link and the housing for urging the return link in an upward direction. Pusher arms 106, shown with broken lines in Fig. 3, are attached to the return link 96, which arms extend horizontally inwards on each side of the shuttles, and are able to contact the lower surface of the support means 60, the function of which will be described below.

The housing is arranged with an opening, through which a return actuating means 108 extends. The return actuating means consists of a slidable button 110 arranged on the outside of the housing and a slide plate 112 on the inside of the housing. A lower edge of the slide plate can be in contact with the upper edge of the return link 96. A recess 116 is arranged on the inner wall of the housing, below the opening, where the upper end of the recess 116 forms a downward facing ledge 118.

The function of the device is as follows. The metered dose chamber is filled with medicament in a known fashion. The inner yoke 64 attached to the upper shuttle 58 hangs on the first protrusion 70, whereby the cam-shaped surface 62 of the support means 60 of the upper shuttle 58 has acted on the guide means 56 of the spacer means 46 so as to pivot them around their pivot axes 48 to an almost upright position, Fig. 5. Because of this, the pressure plate 40 is lifted against the force of the pressure springs, 42 and the spring 26 of the valve assembly 22 has pushed the canister 20 to its uppermost position in the canister holder, whereby the canister is closed. The force of the pressure springs 42 urges the spacer means 46 with a certain force against the support means 60 because the spacer means have a certain angle in relation to a longitudinal plane of the inhaler. Because of the somewhat inclined position of the spacer means and the cam-shape of the support means, the force component Fv of the pressure force F acting in the longitudinal direction of the upper shuttle is rather small, Fig. 5.

To activate the return mechanism of the inhaler Fig. 3, the button 110 is slid downwards by the user, whereby the slide plate 112 abuts the return link 96 and pushes it downwards until the upper edge of the pawl 98 reaches the recess and abuts against the ledge 118.

During this operation, the return spring 104 is compressed. The inhaler is activated and ready to use.

When a user begins to inhale through the mouthpiece, an airflow is created through the air intake 30 arranged at the top of the inhaler, and through the air conduit. The flap 74, arranged in the air conduit adjacent the air intake, is pivoted downwards by the airflow. Due to the pivoting movement, the lower pusher edge 82 pushes the inner yoke off the first protrusion 70 whereby the upper shuttle 58 is moved downwards due to the force of the spacer means 46 acting on the cam-shaped surface 62 by the pressure springs 42. Because of the rather small force component Fv acting on the lower shuttle, the force needed to push the inner yoke off the protrusion by the flap 74 and the lower pusher edge 82 is relatively small. The pushing action is also enabled by the rather long leverage lp of the flap as compared to the leverage lpe of the lower pusher edge, Fig. 6. There is thus no need for a heavy inhalation to activate the device. Preferably, although, the flap 74 should be balanced as regards weight in relation to its pivoting axis 76, so that the inhaler is not activated due to an accidental impact of the inhaler.

The spacer means, also due to the pressure spring, are pivoted inwards until they abut the upper wall 38 of the canister holder, so that the pressure plate, the piston and the canister are moved downwards. Because the stem 24 of the canister is attached to the stationary nozzle 28, the stem is pushed into the metered dose chamber of the canister, thereby opening the connection between the dose chamber and the nozzle. The metered dose is delivered through the nozzle and is mixed with the suction air and enters the respiratory tract of the patient.

The downward movement of the upper shuttle causes the spring 94 between the upper and the lower shuttle 58, 86 to compress and urge the lower shuttle downwards until the outer yoke 88 abuts against the upper surface of the second protrusion 78.

When the user stops inhaling, the air flow terminates, or the air flow drops below a certain threshold value, and the flap 74 is urged upwards again by its pivoting means. This causes the upper pusher edge 84 to push the outer yoke 88 off the second protrusion 78, whereby the outer yoke and the lower shuttle are moved downwards by the force 94 of the spring between the lower and upper shuttles. The downward movement causes the protrusion 90 of the lower shuttle to contact the lower edge of the pawl 98 and to push it towards the housing, whereby the pawl pivots around its axis and the upper edge of the pawl is moved out of the recess 116. The spring 104 between the return link and the housing pushes the return link upwards and the pusher arms 106 of the return link contacts the lower surface of the support means 60 and causes the upper shuttle to also move upwards. Since the lower end of the lower shuttle abuts the ledge 68 of the upper shuttle, it will also be moved upwards. The cam-shaped upper surface 62 of the support means contacts the guide means 56 of the spacer means 46 and these ride along the cam-shaped surface 62, thereby pivoting the spacer means 46 to an almost upright position, whereby the pressure plate 40 and the piston 38 are lifted, the canister is depressed by the spring of the valve assembly and the communication between the metered dose chamber and the nozzle is closed. Due to the cam-shape and the pivoting action of the spacer means, the most force in the longitudinal direction of the upper shuttle 58 is needed during the initial contact and decreases as the spacer means are pivoted, which is the same pressure characteristics as the compression spring 94 possesses. Because of the length l_1 of the arms 54 as compared to the

height h_s of the spacer means, acting as levers, the compression spring 104 can be weaker than the pressure springs 42.

During the return movement from depressed to undepressed position of the canister, the metered dose chamber is refilled and ready for the next dose. It is to be noted that the refilling of he metered dose chamber always is done when the inhaler and canister are held vertically, thus ensuring refilling of the metered dose chamber with medicament, even when small amounts of medicament remain in the canister.

The inhaler could also be provided with detection and monitoring means providing information regarding the inhalation. These normally comprise counters for displaying the number of doses delivered or the number of doses that remain. With the device according to the invention, detection means for detecting the inhalation period may also be included because both the beginning and end of inhalation activates the device. The inhalation period is then an indication of the inhalation quality in the sense that if the device registers that a rather short inhalation has been done, this is an indication that the patient has not inhaled the medicament into the respiratory tract properly. The inhaler could then indicate to the user, to make him aware of this, and to suggest another dose.

The measuring points for the detection means could be any of the moving part of the device of the invention, such as the flap, the shuttles, the pressure means, the yokes, and so forth.

It is to be understood that the invention is not limited to the embodiment described and shown on the drawings but may be altered within the scope of the claims.

For example, the different springs acting in the device may have different configuration and/or attachment points in order to obtain the same function. For example, the pressure means may be a vacuum bellows, known per se. Further, the spacer means may be pivotable plates. Also, the yokes may be replaced by for example hooks.

It is further conceivable to replace the button of the return actuating means with a sleeve, lever or the like of any kind and placement. For example the upper part of the housing may be slidable in respect to the lower part in a vertical direction for activating the return means in the described way. Yet a way of activating the return means is to include a releasable cover around the opening/mouthpiece of the inhaler, and that the cover is connected to the return means. The return means could then be activated when the cover is closed after use, thus activating the inhaler before the subsequent use.

PATENT CLAIMS

1. Device for use with an inhaler (10), the inhaler comprising a body (12), an aerosol canister (20) arranged in said body containing medicament, comprising a metered dose chamber (27) and able to dispense a metered dose of said medicament, a nozzle (28) in fluid communication with said canister, an opening (30) for dispensing of said medicament in fluid communication with said nozzle, said device comprising means (38, 40, 42, 46, 58, 62, 64, 72) for activating said canister to open and dispense said medicament in response to an airflow in the inhaler caused by inhalation of a user through said opening, return means (38, 40, 42 46, 58, 72, 88, 96, 104, 106) for deactivating said canister to close it, c h a r a c t e r i z e d in that said return means deactivates said canister when the airflow drops below a certain threshold value.

2. Device according to claim 1, c h a r a c t e r i z e d in that said return means deactivates said canister in response to ending and/or termination of inhalation.

3. Device according to claim 1 or 2, c h a r a c t e r i z e d in that said activating means comprises first spring means, hereafter named pressure spring means (42), for moving the canister relative the housing to vent the metered dose chamber (27) and that said return means comprises second spring means, hereafter named return spring means (104), for moving the canister relative the housing to an unvented position against the force of the first spring means.

4. Device according to any of the preceding claims, c h a r a c t e r i z e d in that the activating means and return means of the device are operated when the canister is positioned with its outlet facing downwards in the inhaler.

5. Device according to claim 4, c h a r a c t e r i z e d in that the metered dose chamber (27) is refilled/recharged during deactivation of the canister.

6. Device according to claim 3, c h a r a c t e r i z e d in that said return spring means of the return means is activated by the user.

7. Device according to claim 3, c h a r a c t e r i z e d in that said activating means comprises a pressure means (40) in contact with the bottom of the canister, that the pressure spring means (42) are arranged between the pressure means and the housing of the inhaler, spacer means (46) for holding said pressure means, thereby preventing said pressure spring means and pressure means to depress the canister, support means (44) for supporting said spacer means in holding said pressure means, and release/return mechanism (72) which is activated in response to an airflow due to inhalation, whereby, upon activation, the support means releases said spacer means which in turn releases said pressure means and the canister is depressed.

8. Device according to claim 7, c h a r a c t e r i z e d in that the return spring means (104) of the return means is arranged to said support means (44), whereby upon termination of inhalation, said release/return mechanism activates said second spring means to urge said support means in supporting contact with said spacer means, whereby said spacer means urges the pressure means to a position where the canister is no longer depressed.

9. Device according to claim 7, c h a r a c t e r i z e d in that said spacer means (46) are arranged between the pressure means (40) and an upper wall (34) of a canister holder (18), that the spacer means have certain height (hs) and width, height >> width, and are pivotable

around an axis (52) parallel to the upper wall between a position where they are arranged upright with an inclination (α) and a position where they lie flat on the upper wall, that the support means comprises a shuttle (58), hereafter named upper shuttle, movable in a vertical direction provided with an upwards facing cam-shaped surface (62), and first holder means (64, 70) for releasably holding the upper shuttle in an uppermost position, whereby the spacer means are in contact with said cam-shaped surface in such a way that they are in their upright position, whereby, upon inhalation, said release/return means (72) affects the first holder means to release the upper shuttle whereby it is moved downwards due to the pressure spring acting on the pressure means acting on the spacer means.

10. Device according to claim 7, c h a r a c t e r i z e d in that said return means comprises a shuttle (86), hereafter named lower shuttle, movable in a vertical direction and movably connected to said upper shuttle, second holder means (88, 78) for releasably holding the lower shuttle in an uppermost position, activating spring means (94) arranged between the upper and the lower shuttle, contact means (106) movably arranged to the upper shuttle, and release means for releasing the return spring means, wherein, upon inhalation the downward action of the upper shuttle causes the activating spring means to tension, and wherein, upon termination of inhalation, said release/return means (72) affects the second holder means to release the lower shuttle whereby it is moved downwards due to the activating spring means, whereby the release means releases said return means and whereby said return means is forced upwards due to the return spring means, also forcing the shuttles upwards to deactivate said canister.

11. Device according to claim 9, c h a r a c t e r i z e d in that said spacer means comprises levers, (54) extending substantially in the same direction as the height of the spacer means, that the ends of the levers are in contact with the cam-shaped surface of the upper shuttle, where the length of the levers (l_l) is greater than the height of the spacer means (h_s).

12. Device according to any of the preceding claims, c h a r a c t e r i z e d in that it comprises detecting/monitoring means for detecting/monitoring the time between activation and deactivation of the canister.

ABSTRACT

The present invention relates to a device for use with an inhaler (10), the inhaler comprising a body (12), an aerosol canister (20) arranged in said body containing medicament, comprising a metered dose chamber (27) and able to dispense a metered dose of said medicament, a nozzle (28) in fluid communication with said canister, an opening (30) for dispensing of said medicament in fluid communication with said nozzle, said device comprising means (38, 40, 42, 46, 58, 62, 64, 72) for activating said canister to open and dispense said medicament in response to an airflow in the inhaler caused by inhalation of a user through said opening, return means (38, 40, 42 46, 58, 72, 88, 96, 104, 106) for deactivating said canister to close it. The invention is characterised in that said return means deactivates said canister when the airflow drops below a certain threshold value. The device also comprises monitoring of the inhalation time as an inhalation quality measurement.

(Fig. 3)

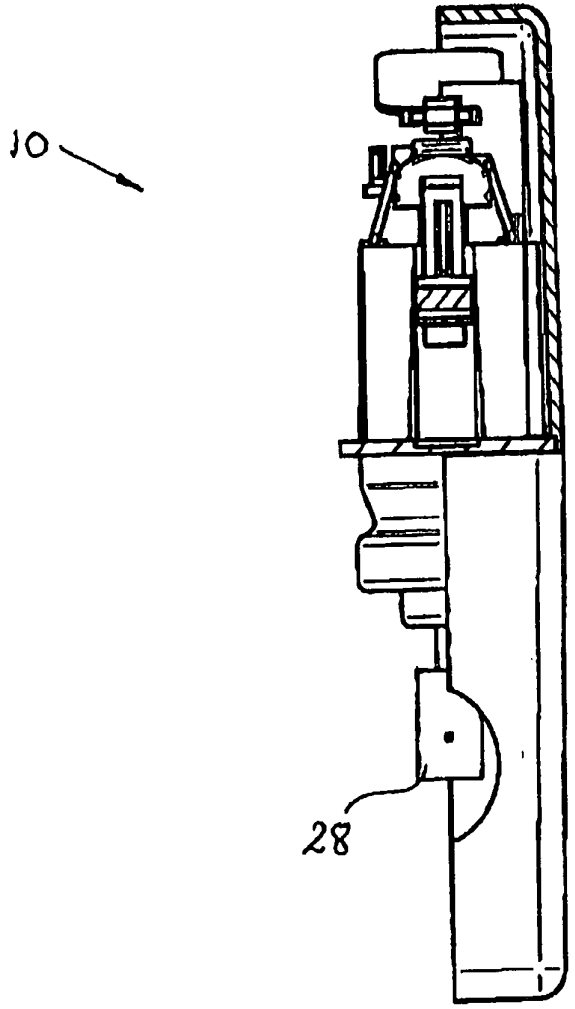

Fig. 1

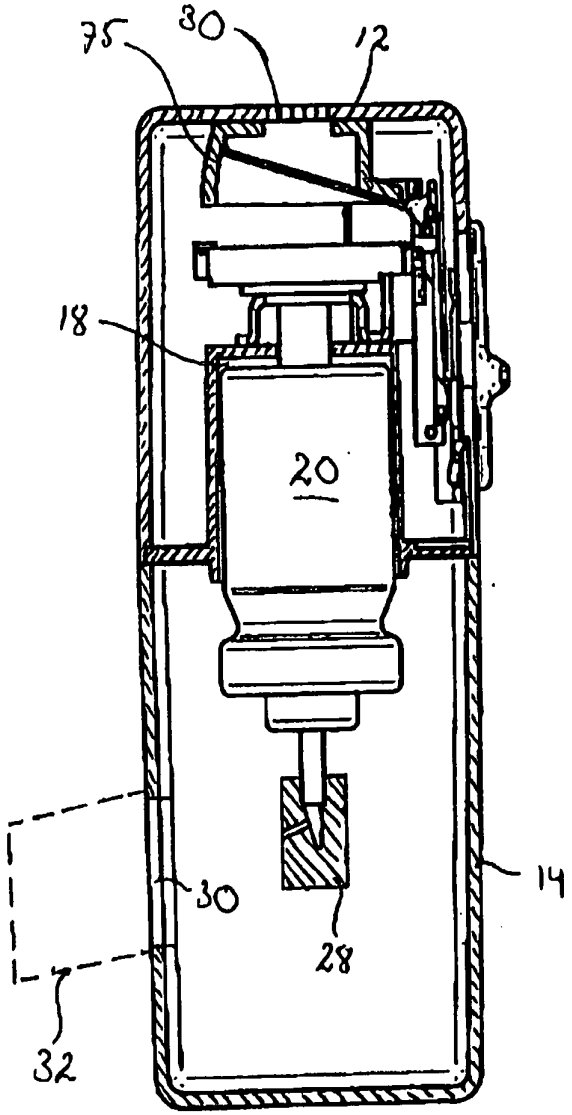

Fig. 2

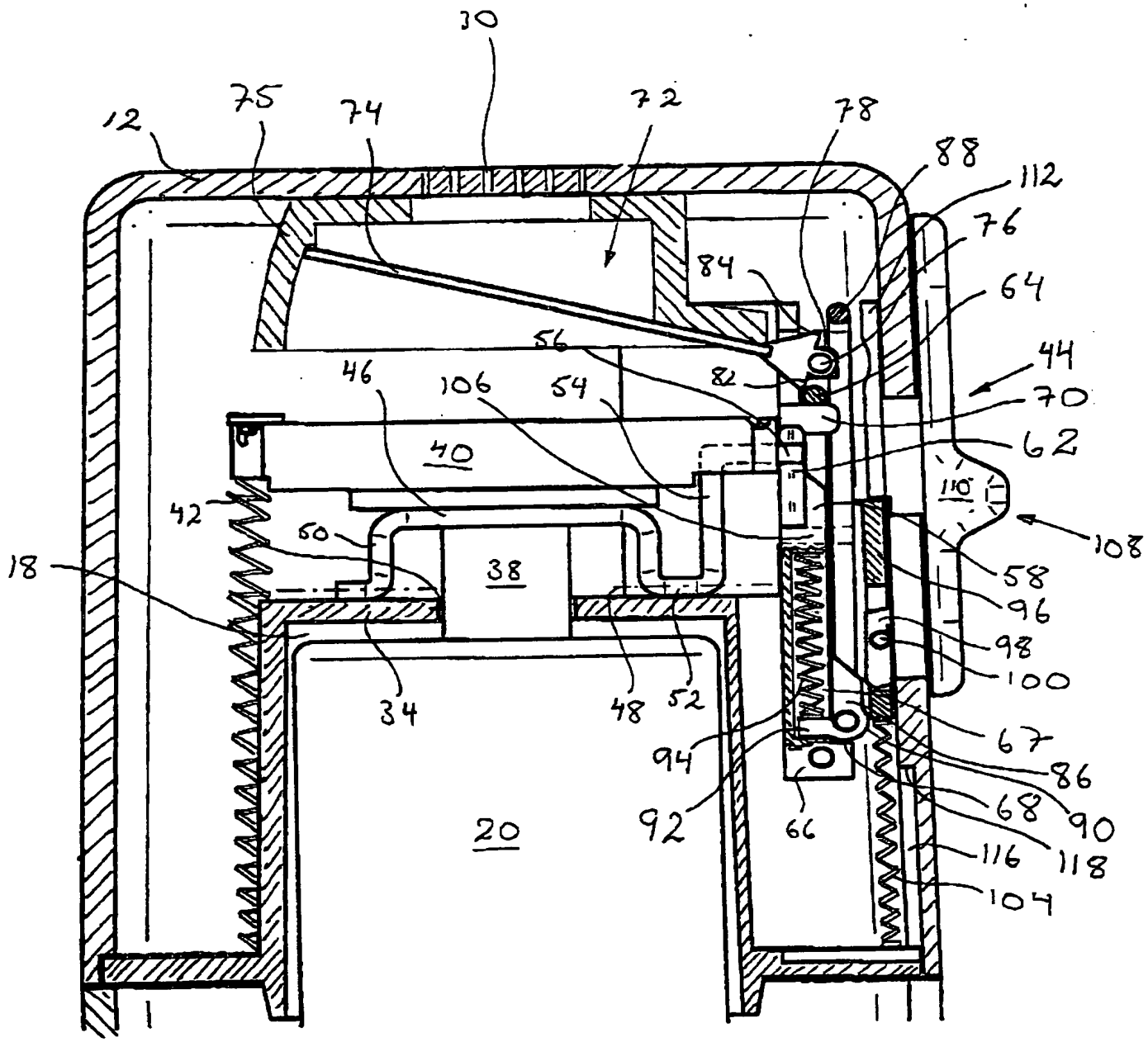
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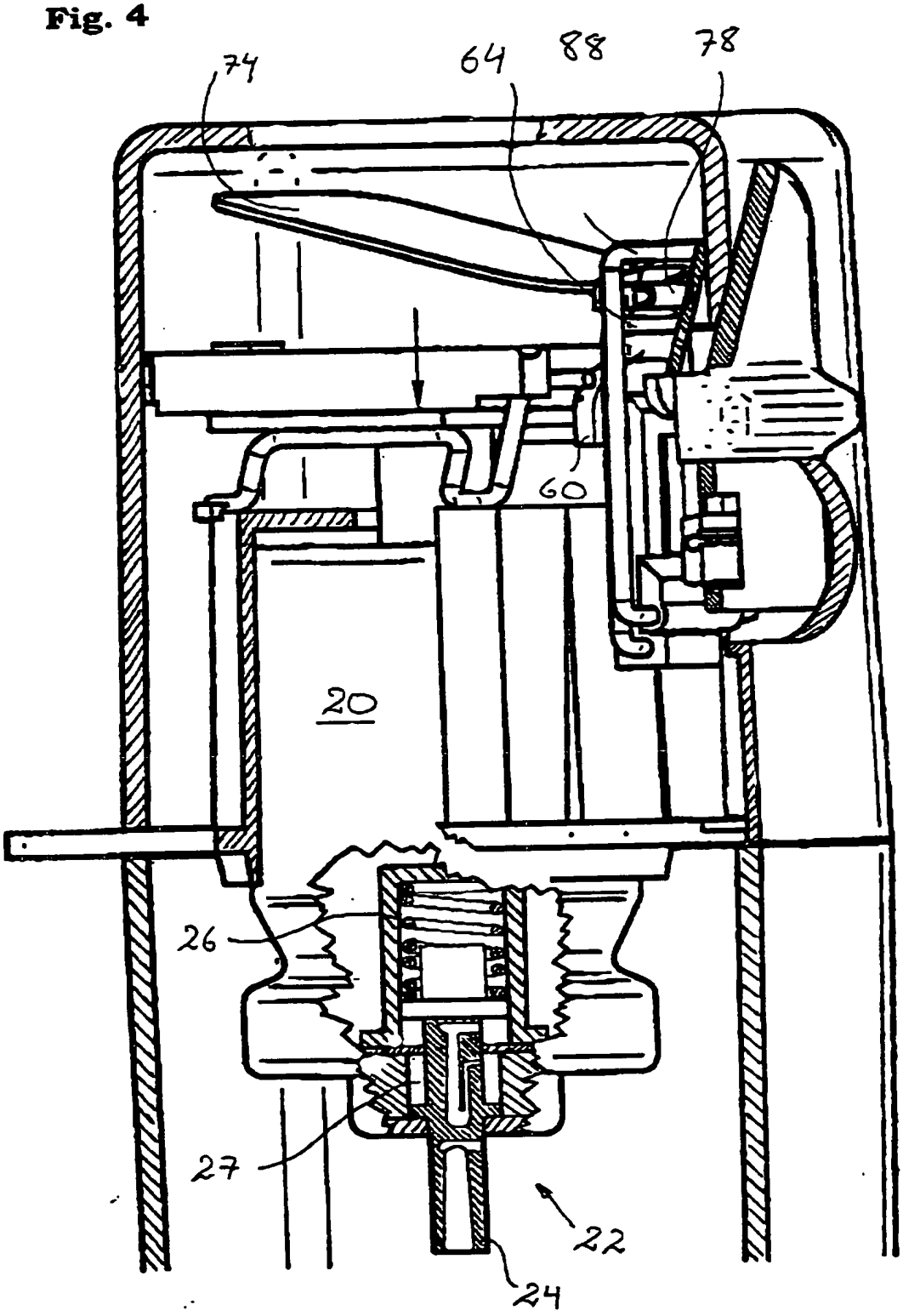
Fig. 3

Fig. 4



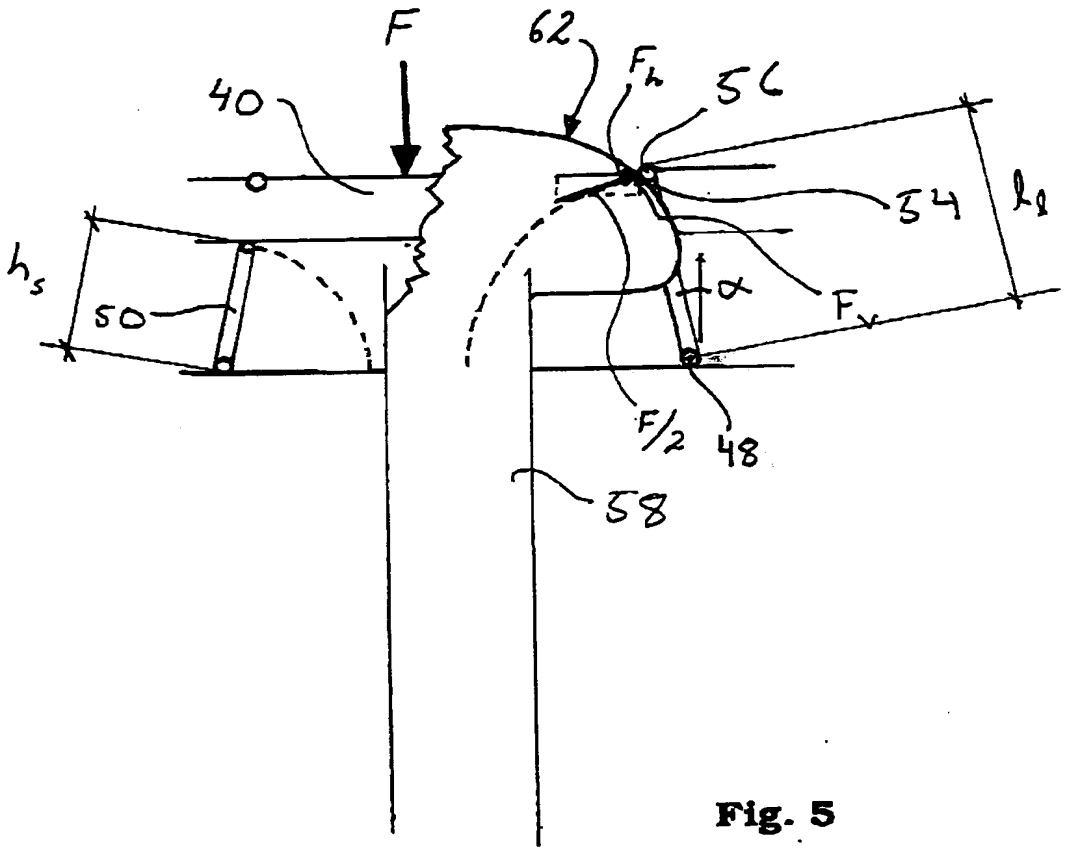


Fig. 5

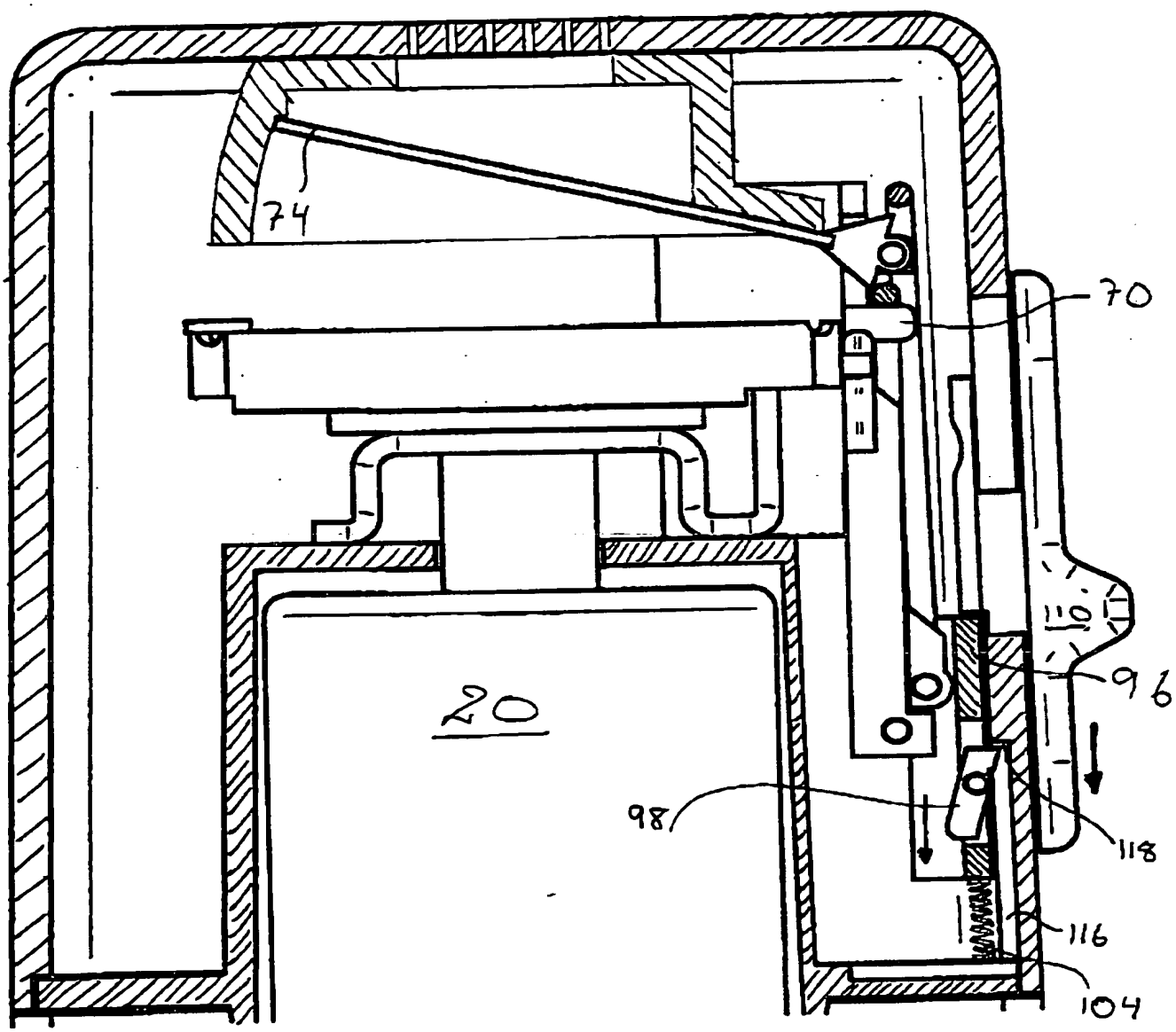


Fig. 6

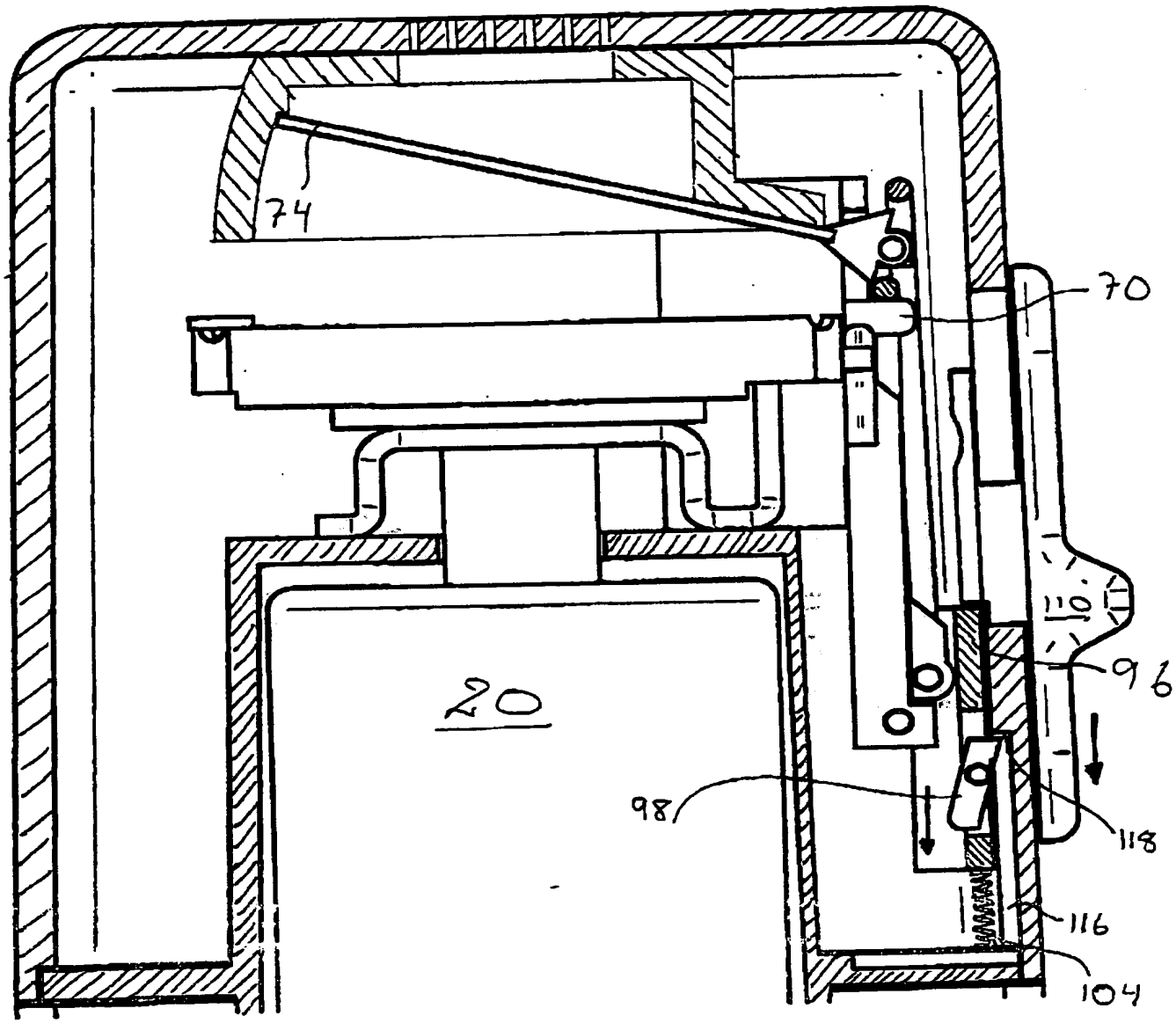


Fig. 6

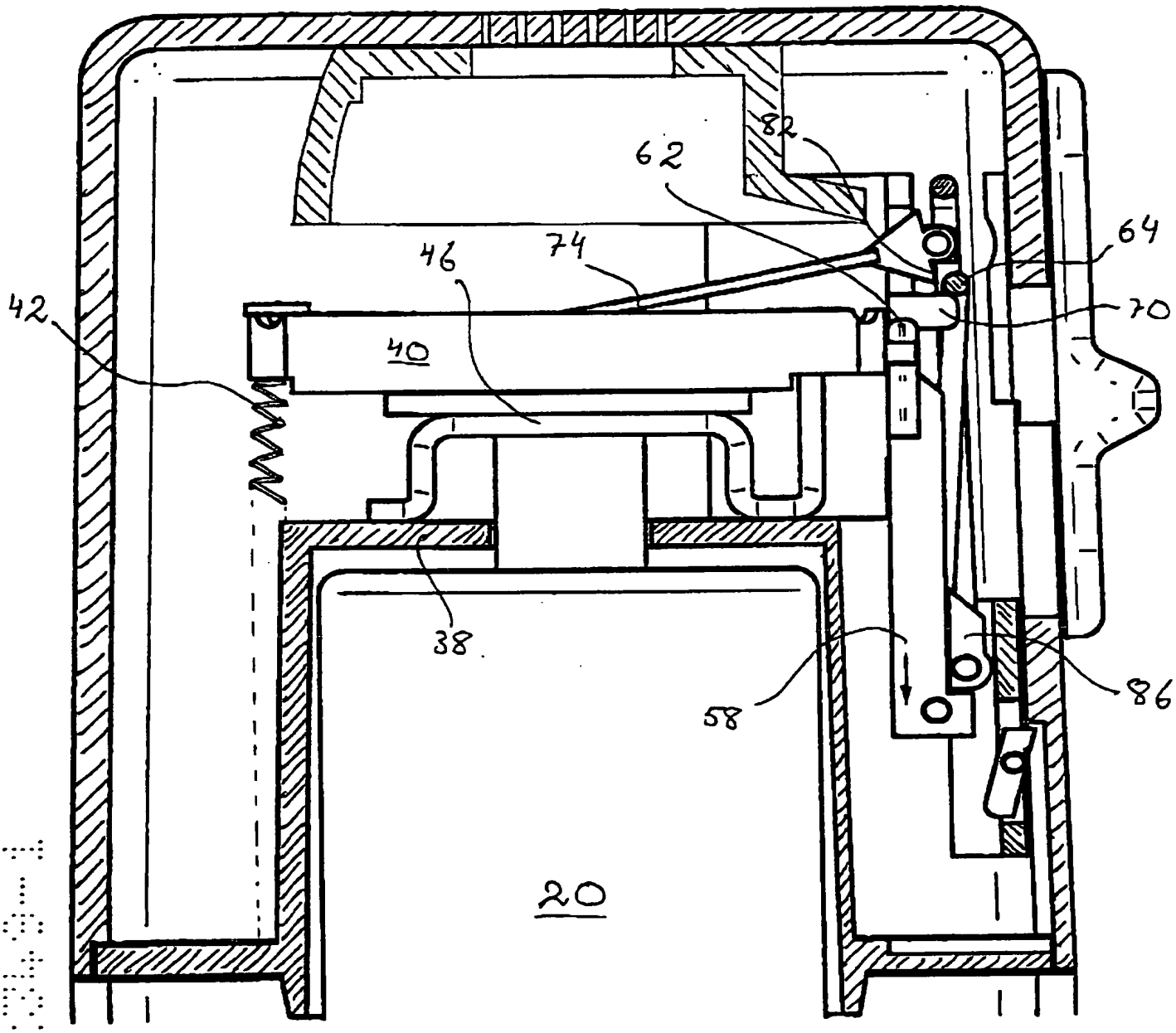


Fig. 7

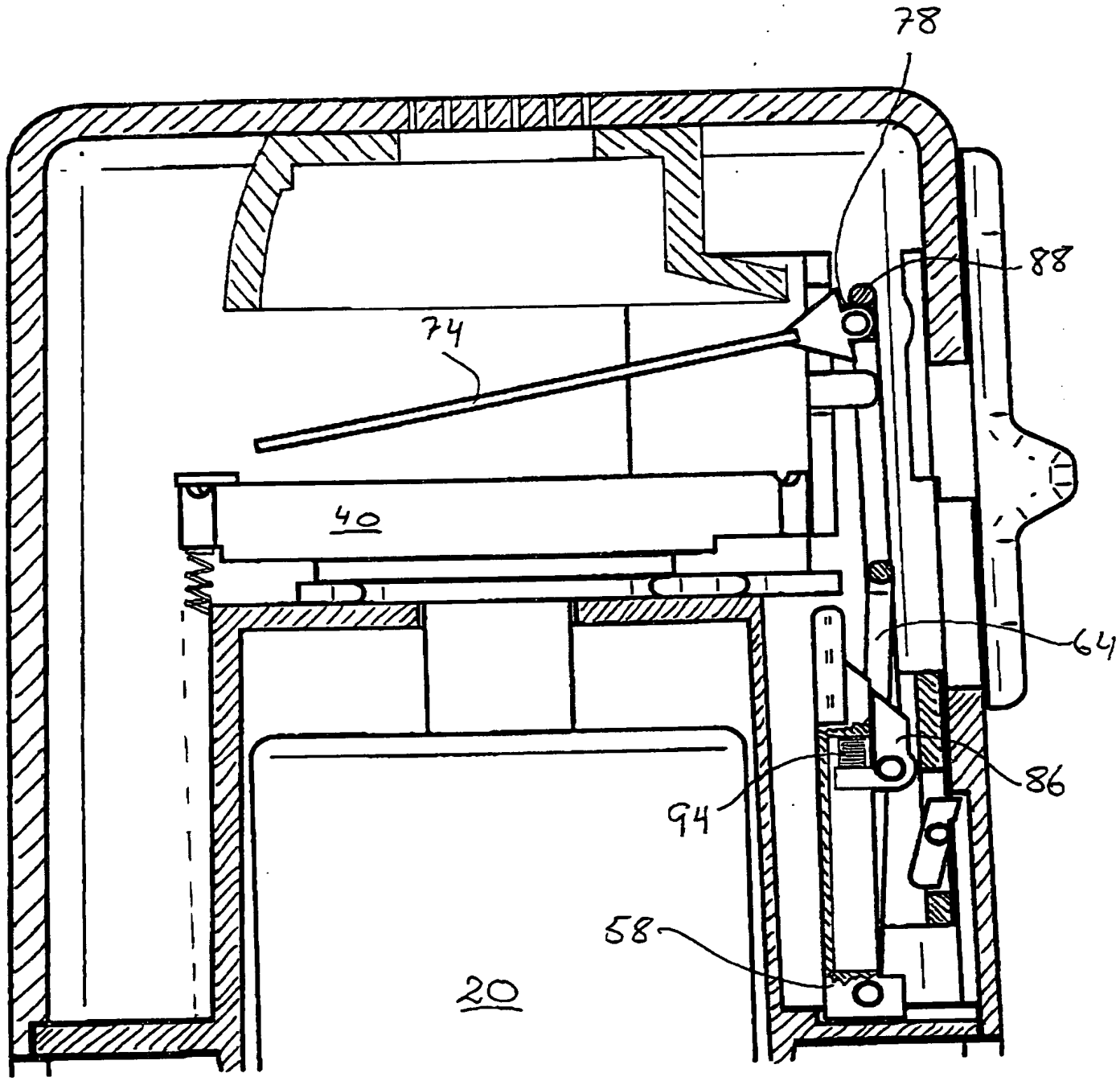


Fig. 8

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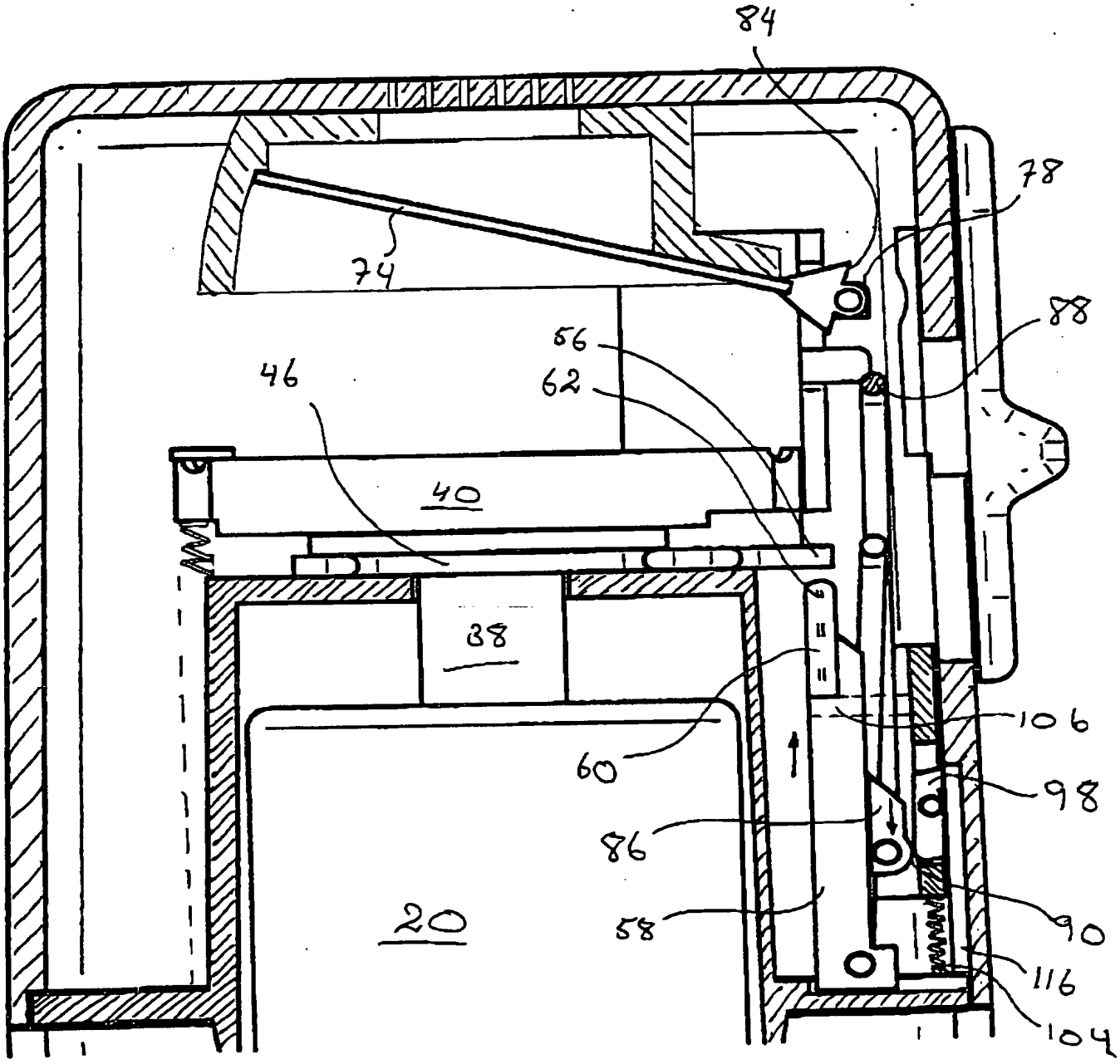

Fig. 9